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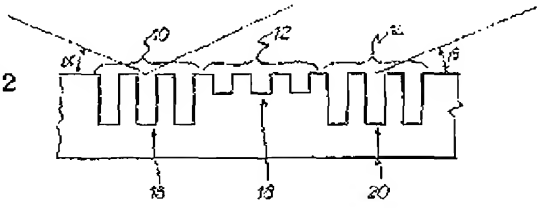
(54)【発明の名称】　光回折効果を有する構造物の配置

(57)【要約】
本発明は、価値を有する書類、例えば、紙幣、クレジットカード、旅券または許可証，あるいは保護すべき他の物品の目視により識別できる光学的セキュリティー要素のための、光回折効果を有する１つ以上の構造物を有する表面領域からなる構造物の配置に関するものである。このような構造物配置を偽造、特に複製することをより難しくするために、この構造物配置が，構造物配置の１つ以上の表面領域（８、30）において所定の視界方向に光学的情報の所定の項目を形成するために、光学的深さの構造物パラメータを除いて同一である構造物（16，18，20；36，38）を有するサブ領域（10、12、14、32、34）が設けられ、構造物（16、20；36）の光学的深さが、サブ領域（10、14；32）の範囲に亘り一定であるが、別のサブ領域（12；34）の構造物（18；38）の光学的深さとは異なるようなものであることが本発明により提案されている。

図２



DETAILED DESCRIPTION

[Detailed Description of the Invention]
The documents with which arrangement this invention of the structure which has the optical diffraction effect is worthy. For example, it is related with the structure arrangement provided with the surface area which has one or more structures with the optical diffraction effect especially about the optical security element which can be checked by the appearance of a bill, a credit card, a passport, a permit, or other articles that should be protected.
When using this kind of structure arrangement, the information item which can be perceived visually can be transmitted to an observer by the entering diffraction and/or refraction of an ambient light. However, if the device provided with the suitable function is used, also making the kind of optical information item **** to a machine will be considered. When the simplest, it is provided in the surface of the surface area of a base material member, and the entering ambient light reflects about diffraction and/or refraction, especially this kind of structure arrangement is given by the straight-line wavelike relief structure. Although the structure in which the term of a wave or a relief structure has a surface line which it is not necessarily fixed about the section of surface area, and is especially a sine wave is not meant about this point, this may also contain a rectangle, a step type, or a wedge type surface structure thing again. Even if those surface structure things are also those periodic or aperiodic-shaped, they do not interfere. The structure which has the optical diffraction effect is not necessarily monopolistically formed with a relief structure, and it is also considered that change is given to the refractive index of a structure.
The information emitted from there with diffraction of the light which penetrates incident light or structure arrangement in the surface area of a structure, and the gestalt of an optical diffraction image is determined by the parameter of a lattice or a structure. In the case of relief structure, reference is made here about the orientation and sectional shape of the wave per unit length of surface area or the number of grid lines, what is called spatial frequency, and a relief structure. Especially sectional shape is determined by both differences about the height between the difference about the height of a relief structure, the difference about the height between each burrs which receive mutually in more detail and the burr of a relief structure and a valley, or a crevice. In the case of the structure formed by change of the refractive index arranged by structure form although not formed with a relief structure, the parameter of a structure is defined by the following, but the refractive index of the effective layer should be taken into consideration still more nearly optically. Although the predetermined item of light information is emitted by shape and arrangement with a suitable structure in a predetermined viewing angle range and is perceived by the observer by them, in another viewing angle range, it is the form that another item of information is emitted, and the structure arrangement which affects the phase relation of incident light can be obtained. Change of the phase relation by structure arrangement is produced by the product of the geometric wavelength in the inside of a refractive index and structure arrangement, or structure arrangement. The light phase difference (OPD) in the case of the wave diffracted or refracted by position x_1 (for example, burr of a structure) and position x_2 (for example, crevice of a structure) is as follows. :

$$OPD\ (x_1, x_2) = \int n\ (x_1, z)\ dz - \int n\ (x_2, z)\ dz\ .$$

Considering the relation, a difference will arise by whether the reflective relief lattice is covered with lacquer as it carries out now. Because, that is because there is a refractive index of not only the difference about height but an enveloping layer, and this is an important thing. Therefore, the information about the truth of the item of the information which can be perceived visually, and the item protected especially which corresponds to the

structure of surface area and for which it depends especially on the degree of lighting angle or a viewing angle is given to an observer with the gestalt of the light which penetrates catoptric light or a structure.
even the inexperienced general public can understand the item of the true and false information about a protector article by using the security element of itself known which has the structure arrangement with the optical diffraction effect about the article which is stated to the beginning of this specification and which should be protected. It can come, simultaneously forgery of the gestalten of the known forged method and the duplicate especially relevant to an optical duplicating method can be made impossible or difficult enough, for example.
By for example, specific change of the structure parameter (difference about the height or phase in the orientation of spatial frequency and a relief structure and sectional shape, and a relief structure) mentioned above. Although the predetermined item of the optical information which is produced from one surface area and which can be perceived visually can be told to an observer in a predetermined viewing angle range depending on a lighting direction, The structure arrangement which haves to be impossible even if it can perceive another item of the optical information produced from another surface area of this structure arrangement in the same viewing angle range is known. By the rotating operation of the base material member which supports the structure arrangement around the axis which extends vertically to the flat surface of the axis in the flat surface of a base material member, or a base material member. The information produced from the surface area (it does not interfere even if especially this surface looks dark) observed first changes, it is one side and optical information is given with the gestalt of the impression of a color by another surface area which looked dark first, for example.
The purpose of this invention is to increase the diversity of the coding option of the optical information which can perceive structure arrangement of the kind mentioned above in making it difficult forgery and to reproduce especially and a viewing angle range.
About formation of the predetermined item of the optical information in the predetermined direction of a field of view of one or more surface areas of structure arrangement, except for the structural parameter of the optical depth, although this purpose is the same and its optical depth of this structure is [/ the range of a sub area] constant, in this invention, The sub area which has a different structure from the optical depth of the structure of another sub area is provided.
Therefore, it is attained.

In the case of a mere relief structure, the optical depth is determined by the geometric depth. This corresponds to the optical bandgap wavelength between two beams reflected in the burr or crevice of its that of a relief structure. In the case of the structure in which refractive indicees differ locally, the optical depth which caused the phase relation of the light diffracted with a structure is given with the thickness from which coating differs further with a different refractive index. It divides with the optical depth of a structure and the quantity of the light diffracted from a geometric reflecting direction, i.e., the diffraction efficiency of the structure, is determined. Thus, except for the parameter of the optical depth, the two same structures tell the item of optical information which is mutually different in the predetermined direction of a field of view. The relevance by this invention with the item of the wave-optical information desired in [of the structure of the 1st predetermined optical depth] a predetermined viewing angle range, In collaboration with relevance with the item of another desirable information of at least one further structure of the 2nd or the further optical depth, the further control or a coding option is given in structure arrangement about the impression of the image which should be told. For example, when the same sub area is established in a structure except for a size undistinguishable in the optical depth and the naked eye, it can tell from the same zone of structure arrangement of the item from which optical information differs. Thus, while the motif or unit of an image formed with the structure of the 1st optical depth becomes color [1st] and appears in the 1st direction of a field of view by arrangement corresponding to the impression of the image of a request of the sub area of the shape by this invention, In another direction of a field of view, it can perceive in color with another motif or unit of an image formed of the sub area of the structure of the 2nd optical depth. in order to acquire such an effect, it turned out that it is preferred to relate the optical depth of each structure with the wavelength or the wavelength range which can be perceived by predetermined vision. However, the optical depth of a structure is related with wavelength or the wavelength range detectable by a mechanical means again. Generally, the diffraction efficiency about the lattice of the conventional rectangle or the lattice of a sine wave is the maximum when it becomes the delay of the phase of pi with the optical depth. since the wave phenomenon is periodic -- the maximum diffraction efficiency -- the delay (2k-1) andpi of a phase, k= 1, and .... it is repeated by the first approximation about the symmetrical lattice type voice which has

the optical depth of N. Geometrically, this depth is first (k= 1) by formula deltaz=R/4n n indicates the refractive index of a cover layer to be.
In **********, it is calculated. In the case of the echelette grating of a saw form, the maximum diffraction efficiency is attained in the depth corresponding to the delay of the phase of 2kpi. A high-ranking (k> 1) lattice is k times larger, therefore manufacturing has the more difficult depth. However, the optimal controllability is a range up to 10 times preferably up to 0 of the wavelength taken into consideration to several times, and is attained about the optical depth about the structure of its that.
When the motif or unit of an image which looks uniform especially is desirable, providing the group of the sub area of the same structure undistinguishable by the naked eye any longer is ****(ed).
Especially, in development of important this invention, except for the parameter of the optical depth, it is the same and the sub area of the structure arrangement containing the structure which only the fractionation of a lattice cycle receives mutually and is arranged relatively is provided. In this case, in the flat surface of a base material, it can arrange by movement to other structures of a structure. However, a structure can also be arranged on a level which is different about height in the vertical direction to the flat surface of a base material so to speak. This arrangement has the optical diffraction effect of the structure in question, and even if that dispersion direction is duplication in the further structure that can extend horizontally to this structure, it does not interfere. Thereby, it becomes possible to protect from a hologram duplicating method. A hologram can usually only be reproduced by manufacturing a hologram from a hologram. Since argon ion or the laser of HeCd has a powerful line in bluish green (488 nm), blue (454 or 442 nm), and an ultraviolet-rays (about 350 nm) frequency range, those laser is mainly used for it as holography laser. Almost all photograph lacquer suitable for holograph type surface relief is also sensitive in the range. In contrast with this, such photograph lacquer is almost insensible in a red frequency range. Red laser (for example, HeNe laser) can also perform manufacture and the duplicate of a hologram clearly. Although a silver content gelatin emulsion (photographic plate) is used for this purpose now, surface relief suitable for galvanic casting or shaping is not formed of these. Here, it becomes difficult it to reproduce this structure using blue laser about a red light about a blue light, when it is that which is dramatically high although the optical depth of a structure has dramatically low diffraction efficiency. It is known by the person skilled in the art at this that a hologram will be reproduced on a red susceptibility photograph emulsion, and can be re-reproduced subsequently to blue susceptibility relief material, although it is clear.
The fault which starts dramatically as for cost is included.

Since the optical information emitted in the predetermined direction of a field of view can be disappeared by the diffraction phenomena of the addition which this produces in order to arrange the structure of a certain sub area relatively to the structure of another sub area, the shape which the sub area mentioned above can perform protection from a duplicate effectively. Thus, in arrangement of a structure, the depth that the diffraction efficiency concerning a blue light in a sub area, for example, the half of a pixel, serves as the minimum can be included. Simultaneously, this means a remarkable thing, although the diffraction efficiency about a red light is not the maximum clearly (about a blue light of R= 442-nm HeCd-laser). The symmetrical rectangle which has the minimum diffraction efficiency about the wavelength, or the optical depth of the lattice of a sine wave is 442 nm correctly. However, about the optical depth, although the level of the diffraction efficiency about the light of the red by the wavelength of about 600 nm is not the maximum, it has a remarkable thing. Another sub area, for example, other halves of a pixel, is the optical depth in which a red light includes the maximum diffraction efficiency, for example, i.e., a 300-nm thing. In a blue light as a moderate light, the sub area or pixel can be perceived about the suitable direction of a field of view. Here, the structure of the 2nd sub area can arrange relatively only the fractionation (about 2pi/3) of the lattice cycle that the ratio of the incident light diffracted from a sub area is substantially distinguished in a red light, to the structure of the 1st sub area. Thus, for example, a dark character can be formed in the red background. When such a hologram is reproduced by blue light, therefore only blue wavelength with specific laser is obtained, since the diffraction efficiency about a blue light is the maximum, the sub area of the optical depth where a structure corresponds to the wavelength in a blue light correctly is not reproduced. What the structure of such the optical depth "is seen for" by a blue laser beam is not made, therefore it cannot reproduce, either. However, about a red light, especially other sub areas that may have the highest diffraction efficiency have the diffraction efficiency of a good level about a blue light, and the structure of the sub area can be reproduced perfect for the reason. When the structure which makes it such and is reproduced by blue light "is read" by red light, the subtraction effect is lost in a red light and a

pattern looks moderate to red in the position. And by the scarce contrast under a red light, the character mentioned above is difficult to read, it cannot read it any longer, but it can distinguish a real structure and duplicate by it.
In order to form the impression of a homogeneous image, the sub area of the kind mentioned above is arranged in the relation which adjoined mutually, and providing two or more sub areas undistinguishable [in particular] by the naked eye any longer is proposed.
Although the gestalt of the relief (lacquer relief) of a monolayer does not necessarily need to have the structure arrangement by this invention, not interfering, even if it is a multilayer system is pointed out. Therefore, it can also push against the multilayer base which consists of a lacquer layer containing a refractive index which is different in a structure. About this point, different lacquer also differs in a refractive index, and also may differ also in respect of absorption. This multilayer system cannot bring about the further cross protection, and cannot reproduce it by the simple holography method.
The further details, the feature, and advantage of this invention are clear from the statement of the following related with an attached drawing and the desirable embodiment of structure arrangement of this invention.
Drawing 1 shows the security element of documents with the value provided with the structure arrangement which consists of two or more surface areas shown in the figure.
Drawing 2 is a sectional view of the structure arrangement by this invention.
Drawing 3 shows two sub areas of the structure arrangement by this invention which has a relief structure arranged mutually.
Drawing 1 shows the base material 2 of the documents which have the value provided with the security element 4. The security element 4 includes the structure arrangement by which the item of the information which can be perceived by viewing is memorized or coded with the gestalt of the image 6. The security element 4 or structure arrangement becomes drawing 1 from the surface area 8 shown in two or more figures which have one or more relief structures which cannot be shown.
Drawing 2 shows some sectional views of the structure arrangement by this invention. Drawing 2 shows the sub areas 10, 12, and 14 which can belong to the same surface area of structure arrangement again especially. There are the rectangular relief structures 16, 18, and 20 in each of the sub areas 10, 12, and 14, respectively. The relief structures 16, 18, and 20 have the same spatial frequency, the same mark space ratio, and the same geometrical shape, and only the geometrical depth differs. The relief structures 16, 18, and 20 are [/ the range of each sub area 10, 12, and 14] constant again.
The depth of each relief structure 16, 18, and 20 relates to the impression of the image searched for in the impression of a predetermined direction, a predetermined color, or a color, for example. Generally, this depth does not interfere noting that it is equal to the multiple of wavelength. According to the information stated to the beginning of this specification, in the case of the relief structure of the rectangle shown separately, The depth is formed between the waves in which the phase contrast of pi is reflected by the burr and valley of a structure (when the structure is covered with the transparent cover layer). The refractive index of the layer is also equal to the quarter of the wavelength which should be taken into consideration, out of which it should come and which should be diffracted with a certain maximum efficiency (or the odd times). Thus, the light which enters in the incidence direction alpha can be perceived with the gestalt of the predetermined color of the sub areas 10 and 14, or the impression of the same relief structures 16 and 20, when it sees from the direction beta of a field of view. If it compares, the relief structure 18 of the sub area 12 can tell the impression of a color that the sub areas differ, by determining the optical depth appropriately. For the purpose of security checking, when a mechanical means detects true and false information, the light of predetermined wavelength hits and ranks second to a security element or its structure arrangement with the predetermined degree of incidence angle, for example, In the predetermined direction of a field of view, while the sub area of the predetermined optical depth is visible to the predetermined color of incident light, other sub areas or the diffraction efficiency of a relief structure is slight so that those sub areas may look dark about the wavelength.
Here, as shown in drawing 3, except for the parameter of the optical depth, the same relief structure can be provided in a sub area with a form with which only the fractionation of a lattice cycle receives mutually and a relief structure is arranged relatively. 30 of the reference number shows the surface area of structure arrangement, for example, the pixel of a security element. The two sub areas 32 and 34 where each has the relief structures 36 and 38, respectively are shown in the surface area 30. The relief structures 36 and 38 are the same except for the parameter of the optical depth. That is, these structures have the shape and the same mark space ratio of the same spatial frequency, the same sectional shape, i.e., the same edge inclination, and the

same flat region. However, about mutually different wavelength, each depth of the relief structures 36 and 38 is chosen so that diffraction efficiency may serve as the maximum. The relief structures 36 and 38 are arranged [as opposed to / the base material flat surface of a security element / only in the fractionation of the lattice cycle g / mutually] relatively again. When seeing the surface area 30, the addition of **** emitted by the sub areas 32 and 34 arises to eyes. The amplitude diffracted in the sub areas 32 and 34 can integrate this addition in fixed quantity about the relative value 1 or Exp (iphi) given by 2 pideltax/g, and the phase phi can show it mathematically.

$$I = (1+\mathrm{Exp}(i\phi)\ .\ (1+\mathrm{Esp}(-i\phi)) = 2 + 2\cos.\phi .$$

Therefore, the luminosity of surface area can be further adjusted by the relative arrangement or the shift of the relief structures 36 and 38 which receives mutually. From the statement mentioned above, only the half of a lattice cycle corresponds to arrangement of a lattice so that the phase shift of pi can disappear by the beam splitter function of structure arrangement of the 1st order of diffraction, for example.

[Translation done.]

* NOTICES *

CLAIMS

[Claim(s)]

1. Worthy documents, for example, bill, credit card, passport, or permit, Or an optical security element which can be checked by viewing of other articles which should be protected sake, in order to be a diffraction mechanism thing which consists of two or more surface areas where each was provided with at least one structure which has the optical diffraction effect and to form a predetermined item of optical information in the predetermined direction of a field of view, One or more surface areas provided with the same grids structure thing except for a structure parameter of the optical depth are provided, and [the range of surface area], although the optical depth of this grids structure thing is constant, In a different diffraction mechanism thing from the optical depth of a grids structure thing of another surface area, A structure, wherein only fractionation of a lattice cycle receives mutually and said grids structure thing (36, 38) is relatively arranged in each field of surface area (30, 32, 34) provided with the same grids structure thing (36, 38) except for a parameter of the optical depth.
2. Structure of claim 1 statement, wherein the optical depth of each of said grids structure thing is connected with wavelength range which can be used for wavelength or this purpose of light possible [consciousness] or detectable with machinery by predetermined viewing which achieves function to observe this structure.
3. Structure of claim 2 statement characterized by the optical depth of each grids structure thing of said surface area in field of before [0 to 10 of wavelength of light which can be used for observing said structure times].
4. It is a structure of one statement 3 either from the claim 1 characterized by a group of surface area (10, 14) of the same structure (16, 20).
5. It is a structure of one statement 4 either from the claim 1, wherein said surface area (8, 10, 12, 14, 30, 32, 34) is arranged at a relation which adjoins mutually.
6. It is a structure of one statement 5 either from the claim 1, wherein a grids structure thing (36, 38) arranged mutual [said] is a thing of character which harmonizes one side with another side continuously.
7. It is a structure of one statement 6 either from the claim 1 provided with a multilayer relief system.

[Translation done.]

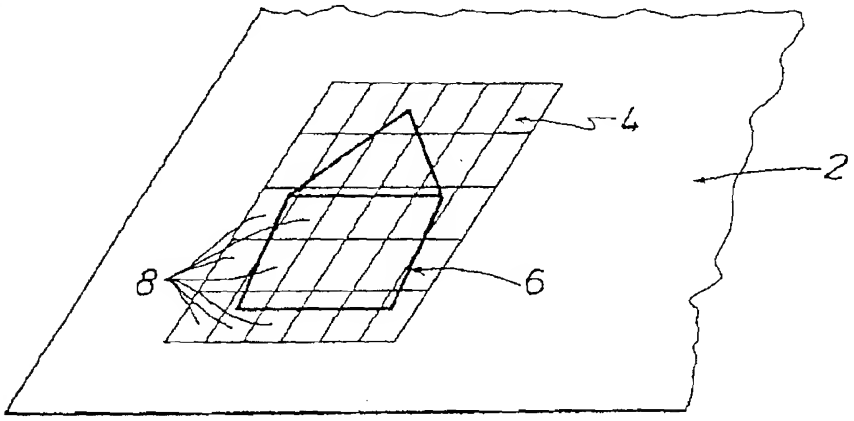
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

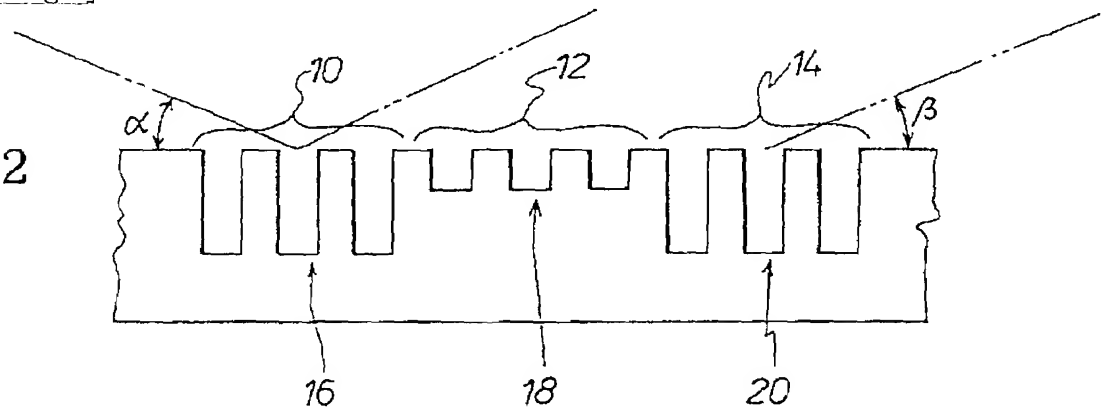
[Drawing 1]

図 1



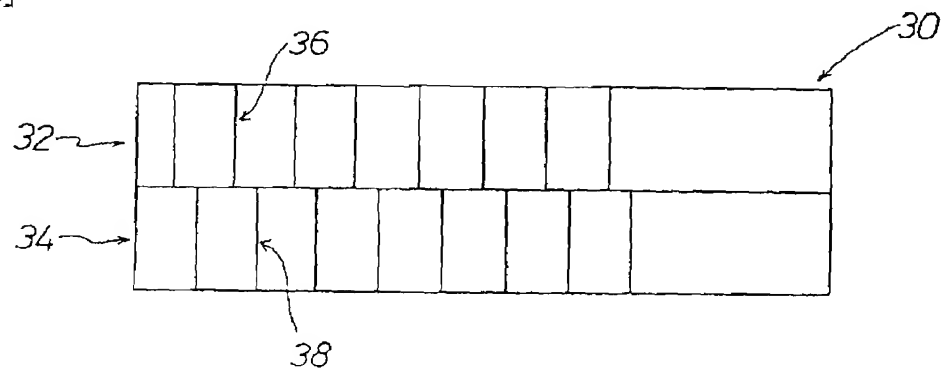
[Drawing 2]

図 2



[Drawing 3]

図 3



JP,11-505046,A [DRAWINGS]

[Translation done.]